Geomechanical Rock Mass Characterization of Variscan Crystalline Rocks in the Bavarian Forest (Germany)

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Introduction
Geomechanical characterization of rock mass becomes more and more important in applied projects (e.g. road construction, railways, dams, repositories and quarrying) due to the prescribed safety regulations. The Bavarian Forest, located in the northeastern part of Bavaria (Germany), belongs to the Variscan basement and is an appropriate study site for geomechanical investigations due to its geology (Fig. 1). Highly metamorphic rocks of the Moldanubic zone (e.g. gneiss), dominate the southernmost part of the Variscan mountains. During the Carboniferous, 340 to 310 million years ago, magma intruded into the surrounding Variscan basement and formed plenty of granitic plutons (Variscan granitoids) (MESCHEDE 2015). After cooling, heavy tectonic stress and erosion these fractured rocks are exposed the exogenic forces on the surface nowadays. The granitoids are still quarried at several sites for extraction of broken and natural stone.

In this context, quantitative discontinuity parameters (e.g. orientation, persistence, spacing, etc.) as well as geotechnical parameters of the exposed rocks will be determined by different field and laboratory tests.

Fig. 1: Schematic geologic map of the Bavarian Forest with its granitoid intrusions (after LEHRBERGER 2013).
Discontinuity Analysis
The recognition and analysis of discontinuities and the characterization of their geomechanical properties is a classical discipline in engineering geology. Discontinuities are significant, mechanical relevant, nearly planar fractures of negligible tensile strength within a rock mass and caused by any tectonic or geological process (PRIEST 1993, ISRM 1978). Joints for example frequently occur in systematic, sub-parallel fracture sets providing a tectonic stress indication in the regional context, since they are usually associated with major fault systems (ATTEWELL & FARMER 1976, PRIEST 1993). The potential of rock slope failure due to critical discontinuity intersections and planar sliding plays a major role in rock slope hazard assessment, especially in artificial outcrops such as quarries (ATTEWELL & FARMER 1976). Therefore, discontinuity properties such as frequency, average orientation and average spacing are quantified by various approaches in order to describe the geomechanical behavior of the rock mass (PRIEST 1993).

In the current dissertation, three methods are applied and evaluated: scanline sampling, photogrammetry and terrestrial laser scanning (TLS). The results will be compared with each other and with those of the research of ZEITLHÖFLER (2007).

Geotechnical laboratory tests
To characterize the geomechanical behavior, laboratory tests will be carried out to determine the material strength, the abrasivity and the mineralogical composition.

Conclusion
The generation of a combined database consisting of quantitative discontinuity data and geotechnical parameters provided by laboratory tests offers an enhanced approach of rock mass characterization (Fig. 2).

Fig. 2: Graphic project outline of the dissertation.

This dissertation contributes to an improved understanding of the tectonic stress regime in the Bavarian Forest and to the provision of geomechanical parameters for construction projects and quarry extraction planning.

References


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